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LLNL-CONF-666685

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January 29, 2015

SPIE Optics + Photonics 2015
San Diego, CA, United States
August 9, 2015 through August 13, 2015

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Optics and Photonics for Information Processing IX

Part of the SPIE International Symposium on Optical Engineering + Applications
*San Diego Convention Center • San Diego, CA USA
August 9 – 13, 2015

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ABSTRACT

The Advance Radiographic Capability (ARC) at the National Ignition Facility (NIF) is a laser system that employs up to four petawatt (PW) lasers to produce a sequence of short pulses that generate X-rays which backlight high-density inertial confinement fusion (ICF) targets. ARC is designed to produce multiple, sequential X-ray images by using up to eight backlighters. The images will be used to examine the compression and ignition of a cryogenic deuterium-tritium target with tens-of-picosecond temporal resolution during the critical phases of an ICF shot. Multi-frame, hard-X-ray radiography of imploding NIF capsules is a capability which is critical to the success of NIF's missions. As in the NIF system, ARC requires an optical alignment mask that can be inserted and removed as needed for precise positioning of the beam. Due to ARC's split beam design, inserting the nominal NIF main laser alignment mask in ARC produced a partial blockage of the mask pattern. Requirements for a new mask design were needed. In the paper we describe the ARC mask requirements, the resulting mask design pattern, and the image analysis algorithms used to detect and identify the beam and reference centers required for ARC alignment.

Key words: Advanced Radiographic Capability (ARC), Optical alignment, mask design, image processing, image analysis, National Ignition Facility (NIF),

*This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.